Description

Manual grinding tool

The invention relates to a manual grinding tool comprising a rotating grinding head.

In conventional grinding tools of that kind comprising a grinding head mounted on one side, it is the responsibility of the user to guide the grinding head as accurately as possible by means of his arm movements and by exerting appropriate retaining forces and contact pressures. In order to achieve a high material removal rate, high contact pressures are necessary, the exertion of which runs counter to accurate guidance of the grinding head.

The object of the invention is to provide a novel grinding tool of the type mentioned at the beginning which enables workpieces to be machined more precisely at a high material removal rate.

The grinding tool, which achieves this object, according to the invention is characterized by a guide device which is connected to the tool and can be placed against a workpiece in a sliding and/or rolling manner and with respect to which the grinding head assumes a fixed position and by means of which the tool can be pressed against the workpiece in at least one direction in a stable manner without tilting.

Advantageously, the grinding head of such a tool can be accurately guided at a high contact pressure against the workpiece by virtue of the fact that the rotation axis of the grinding head remains at a stable angle in at least one direction, the guide device permitting degrees of

freedom for moving the tool manually in the feed direction of the grinding head and if need be in the infeed direction decisive for the removal depth.

The guide device can advantageously be pressed against the workpiece with at least three bearing points in two directions in a stable manner without tilting, so that the grinding head can be guided with uniform inclination with respect to the workpiece surface. The bearing points may lie in one plane in accordance with a flat workpiece surface. However, it is also conceivable to place the guide device with three bearing points against the lateral surface of a cylindrical workpiece, whose lateral surface or end edge is to be machined.

In an embodiment of the invention, the guide device has a bearing surface which can be adapted to a workpiece surface, e.g. a flat bearing surface which can be placed against a side of a plate-shaped workpiece.

In an embodiment of the invention, said workpiece surface adjoins a workpiece edge, and the grinding head is provided for machining the workpiece edge or/and a marginal surface of the workpiece adjoining the workpiece edge, e.g. a marginal surface of a workpiece plate.

In the last-mentioned embodiment, the bearing surface may be formed, for example, by an annular surface coaxial to the grinding head. However, a conceivable guide device would also be a roller having a rotation axis perpendicular to the rotation axis of the grinding head, the roller rolling on the workpiece surface adjoining the marginal surface.

The user of the tool can exert a contact pressure in such a direction that one component acts on said workpiece surface and the other component acts via the grinding head on the marginal surface to be removed. In particular due to the component acting on the workpiece surface, the tool is held on the workpiece in a stable manner without tilting and can be accurately guided at a high contact pressure.

Furthermore, the guide device may comprise a stop element for bearing against the marginal surface. The maximum material removal can be advantageously limited by such a measure.

In an alternative embodiment, the grinding head is arranged between a plurality of stop elements which are provided for bearing against a workpiece surface. Such a tool can serve to grind the workpiece surface, it being possible for the stop elements to have different heights in such a way that the rotation axis of the grinding head is at a desired angle to the workpiece surface when the stop elements bear against the workpiece surface. With a conical surface of the grinding head, provision may thus be made for the nearest generating line of the grinding head to run parallel to or tangentially to said surface. Such a grinding tool can advantageously be used for removing welds projecting from workpiece surfaces.

In a further embodiment of the invention, the guide device may comprise stop elements acting on opposite sides of a workpiece, e.g. a plate or a pipe, at least one of the stop elements being movable in order firstly to make it easier to insert the workpiece into the intermediate space between the stop elements and secondly

to be able to adapt the guide device to different workpiece thicknesses.

The guide device may be adjustable and may be pivotable about an axis in particular for setting different angles of bevels to be ground and may be capable of being locked in desired pivoted positions.

The invention is explained in more detail below with reference to exemplary embodiments and the attached drawings referring to these exemplary embodiments. In the drawings:

fig. 1 shows a first exemplary embodiment for a grinding tool according to the invention comprising a conical grinding head and an annular guide device,

fig. 2 shows a second exemplary embodiment for a grinding tool according to the invention comprising a cylindrical grinding head and an annular guide device,

fig. 3 shows a third exemplary embodiment for a grinding tool according to the invention comprising a disk-shaped grinding head and a guide device acting on opposite sides of a workpiece,

fig. 4 shows a fourth exemplary embodiment for a grinding tool according to the invention comprising a guide device according to fig. 3 and a conical grinding head,

fig. 5 shows a fifth exemplary embodiment for a grinding tool according to the invention comprising a guide device pivotable in its entirety,

fig. 6 shows a sixth exemplary embodiment of a grinding tool according to the invention comprising a grinding head arranged between stop elements of a

guide device,

fig. 7 shows a seventh exemplary embodiment for a grinding tool according to the invention, and

fig. 8 shows a further exemplary embodiment for a grinding tool according to the invention.

A manual grinding tool has a housing 1 for a motor/gear unit (which cannot be seen in the figures), a handle 2 with a switch button 3, and a holding stirrup 4 on the housing end remote from the handle.

In a housing extension 5 extending at right angles to the housing longitudinal axis, a shaft 18 connected to the motor/gear unit can be rotated about an axis 6. At its end remote from the housing 1, the shaft 18 is connected to a grinding head 7.

An annular stop 8 forming a guide and having a flat stop surface 15 coaxially surrounds the grinding head 7. The housing extension 5 has a section 9 which comprises the stop 8 and can be screwed to the rest of the grinding tool. The stop 8 can be axially adjusted by rotating the section 9 and can be locked by a ring nut 16. A further ring nut 17 serves to connect the grinding head 7 to the shaft 18.

As fig. 1 shows, a bevel can be ground on a marginal edge 20 of a plate-shaped workpiece 19 by means of the grinding tool. By adjustment of the annular stop 8 in the direction of the axis 6, the application point or the application surface on the grinding head 7 can be displaced and uniform wear of the conical grinding surface of the grinding head can be achieved as a result.

To adjust the guide or the stop 8 in the direction of the rotation axis 6 of the grinding head 7, the section 9 could also be guided in a rotationally locked manner and be coupled axially to a freely rotatable nut.

For the purpose of uniform wear of the grinding surface of the grinding head, the guide or the stop 8 could oscillate in the direction of the grinding-head rotation axis 6. A separate drive motor or pneumatic cylinder could be provided for the oscillating adjustment. However, an adjusting drive could also be connected to the drive of the grinding head 7, for example, via epicyclic or worm gearing. The section 9 may be provided with a winding groove, in which a guide pin or roller connected to the drive device engages, so that the encircling guide pin or the encircling roller displaces the section 9, guided in a rotationally locked manner, back and forth. Fig. 8 shows a further embodiment having an oscillating grinding head.

During the grinding, the user presses the flat stop surface 15 of the annular stop 8 against the plate surface, adjoining the edge 20, of the workpiece 19. A component of the contact pressure that is parallel to the plate surface provides for the desired material removal by the grinding head. A component of the contact pressure that is perpendicular to the plate surface ensures guidance of the grinding head 7 in a stable manner without tilting, the rotation axis 6 of said grinding head 7 merely being displaced in parallel while maintaining its spatial direction during the grinding. An increase in the contact pressure advantageously leads to the increase in both the material removal rate and the tilting moment, so that the tool can also be reliably

guided at a high contact pressure and a high removal rate.

Due to the annular shape of the stop 8, the tool is especially suitable for machining concavely running workpiece edges.

The grinding head 7 is described in detail in DE 10 2004 016 565.3 included here.

In the figures below, identical parts or parts having the same effect are designated by the same reference numerals as in fig. 1, the letter a, b, etc., being added to the relevant reference numeral.

The grinding tool of fig. 2 differs from the preceding grinding tool in that a cylindrical grinding head 7a is provided instead of a conical grinding head 7. A marginal surface 14 of a workpiece 19a can be machined by means of this tool.

This grinding tool can also be reliably guided at a high contact pressure, a component of the contact pressure that is perpendicular to the plate surface of the workpiece 19a providing for the stability of the rotation axis of the grinding head without tilting, and a component that is parallel to the plate surface provides for the desired material removal.

A manual grinding tool shown in fig. 3 and having a housing 1b has a disk-shaped grinding head 7b. Attached to a housing extension 5b as a component of a guide device 8b is a carrier 10, which is connected to a first stop element 11 and a second stop element 12. The stop

elements 11 and 12 act on opposite sides on a workpiece 19b in a rolling manner via rotatably mounted balls 26.

The stop element 12 can be adjusted by means of a lockable setscrew 21 for adaptation to different workpiece plate thicknesses. Furthermore, the stop element 12 has an extension arm 22 having a stop roller 23. A tapered surface 24 of the stop roller 23 can be placed against a marginal surface 14b of the workpiece 19b.

By means of the guide device 8b, the grinding tool can be kept at a desired angle with respect to the plate surfaces of the workpiece 19b in a stable manner without tilting. By movement of the tool perpendicularly to the paper plane, a bevel can be ground on an edge 20b of the workpiece 19b by means of the tool, the grinding tool being tilted relative to the position shown in fig. 3, so that the grinding wheel 7b is at an angle to the edge 20b in the feed direction.

In the exemplary embodiment in fig. 4, the grinding is effected in such a tilted position that the grinding generating line of a conical grinding head 7c runs parallel to a workpiece edge 20c.

In the exemplary embodiment of fig. 5, a guide device 8d is designed in a similar manner to the embodiments according to figs 3 and 4. However, the entire guide device 8d is rotatable about an axis 25 and can be locked in desired rotary positions.

A stop element 12d can be pivoted about an axis 27 by means of levers 26. The levers 26 are attached to fork

legs 28, between which a grinding head 7d is arranged, which engages in a recess in a stop element 11d.

In the stop position, shown in fig. 5, of the stop element 12d, the levers 26 engage in a guide 29 in the relevant fork leg 28, as a result of which rotation of the stop element 12d about the axis 27 is blocked. In this position, the force of a disk spring 30 acts on the stop element 12d. The contact pressure can be adjusted by the helical spring 30 by means of a knurled nut 31.

By means of the tool shown in fig. 5, bevels 20d can be ground at different angles on workpieces 19d depending on the pivoted position of the guide device 8d.

A manual grinding tool shown in fig. 6 has a guide device 8e which is intended for placing against a flat surface 32 of a workpiece 19e.

The guide device 8e consists of a support plate 33 which is connected to a housing extension 5e of the grinding tool and from which stop elements 34 and 35 in the form of elongated supporting feet of different height project. A grinding head 7e having a conical grinding surface is arranged between the stop elements 34 and 35, which are provided with rollers 36. The difference in height between the stop elements 34, 35 is dimensioned in such a way that the respective generating line, nearest to the workpiece 19e, of the conical grinding surface 7e runs parallel to the surface 32.

The grinding head 7e could be displaceable with respect to the rest of the tool and could be acted upon by a spring in such a way that the contact pressure of the

grinding head against the workpiece is increased by increasing the contact pressure of the tool against the surface 32.

A weld 37 projecting from the surface 32 can advantageously be ground off by means of the tool of fig. 6, the guide device 8e guiding the grinding head 7e parallel to the surface 32. In addition, the rollers 36 provide for linear guidance along the weld 37.

A grinding tool shown in fig. 7 and comprising a grinding head 7f has a guide device 8f with two rollers 38 and 39. The rollers are attached at one end to a support plate 40 which is perpendicular to the roller axis and which in turn is connected to a holder 41 which can be pivoted about an axis 25f and can be locked in desired pivoted positions. The holder 41 can be varied in its length for adjusting the grinding point.

The end edge of a tubular workpiece 42 can be machined with the tool, the rollers 38 and 39 of the guide device 8f rolling on the outer or inner lateral surface of the pipe length, while the support plate 40 bears against the end of the pipe length. The bevel angle to be ground can be set by pivoting the guide device 8f, and the grinding point at the conical grinding surface of the grinding head 7f can be varied by adjusting the length of the holder 41.

The workpiece 42 has sufficient play between the rollers 38 and 39 in order to be able to pivot the tool for varying the infeed and thus the removal depth.

Instead of two rollers, four rollers could also be

attached to the support plate, and the grinding head could be displaceable relative to the support plate for varying the infeed.

In an exemplary embodiment shown in fig. 8, a drive shaft 18g for a grinding head 7g is connected to gearing 51 via a driving belt 50. A gear 52 attached to the gearing 51 on the output side meshes with a gear 53 which is connected to a bush part 9g. The bush part 9g is rotatably mounted at 54 on a housing extension 5g. A further bush part 55 arranged between the bush part 9g and the housing extension 5g and connected to an annular stop 8g has a curved annular groove 56, in which a cam 57 projecting inward from the bush part 9g engages. Lugs 59 projecting inward from the bush part 55 engage in longitudinal grooves 60 in the housing extension 5g, with an anti-rotation locking means being formed.

The gearing 51 reduces the speed of the drive shaft 18g to a few revolutions per minute. The cam 57 of the bush part 9g driven via the gears 52 and 53 displaces the further bush part 55 axially according to arrow 58, so that the annular stop 8g performs an oscillating movement.